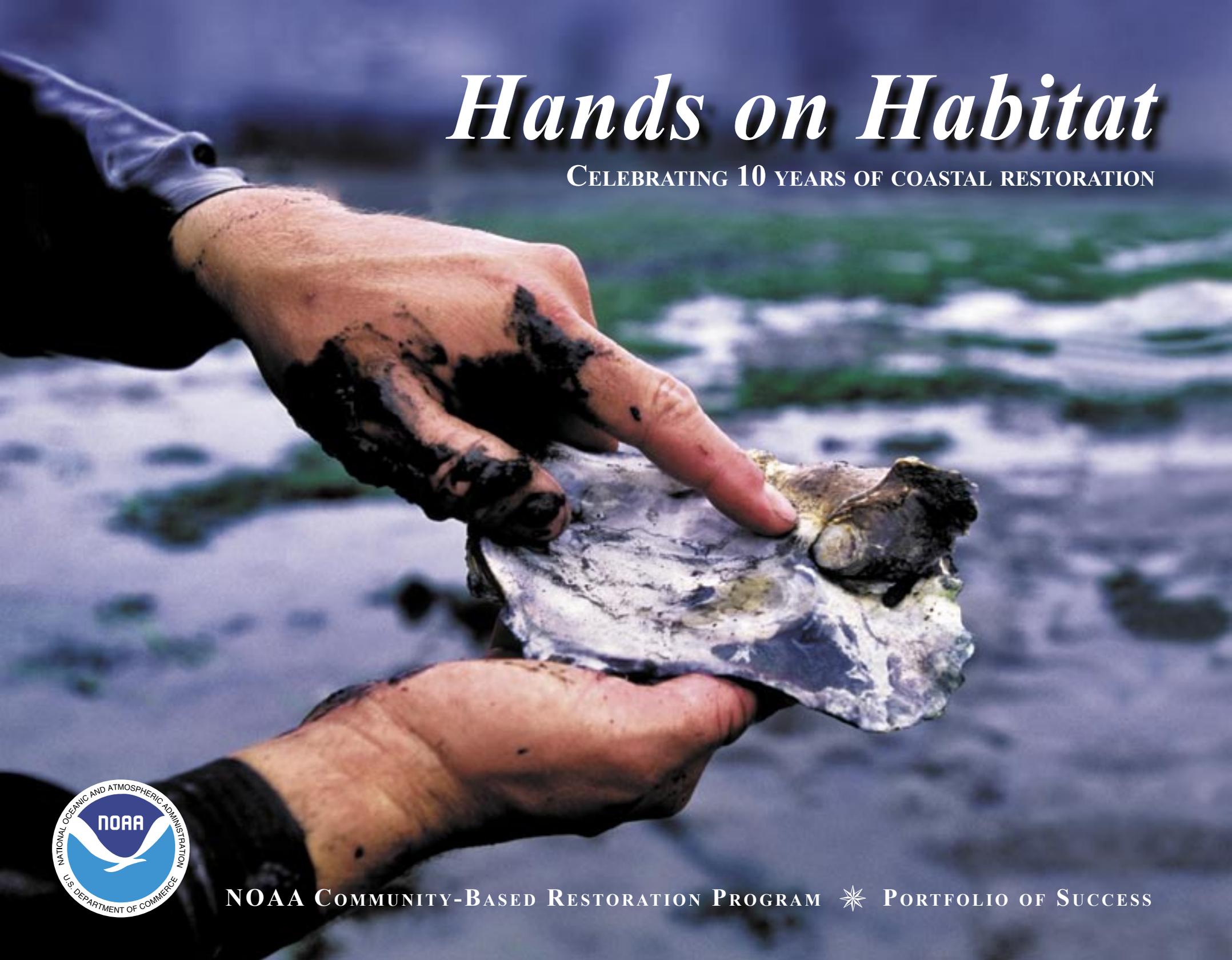


# *Hands on Habitat*

CELEBRATING 10 YEARS OF COASTAL RESTORATION



NOAA COMMUNITY-BASED RESTORATION PROGRAM ✦ PORTFOLIO OF SUCCESS



#### **Mission**

The NOAA Restoration Center restores habitats for the nation's living marine resources. Through partnerships, the Restoration Center restores degraded habitats; advances the science of coastal habitat restoration; transfers restoration technology to other government agencies, the private sector, and the public; and fosters long-term stewardship of marine and coastal habitats.

#### **History**

The NOAA Restoration Center is the focal point for habitat restoration within NOAA. Housed in NOAA's National Marine Fisheries Service, the Restoration Center performs restoration pursuant to federal legislation and improves the state of restoration ecology and habitat management. To meet its goals, the Restoration Center implements four complementary programs: the Coastal Wetland Planning, Protection, and Restoration Act Program; the Damage Assessment, Remediation, and Restoration Program; the Restoration Research Program; and the Community-based Restoration Program, the focus of this publication.

Congressional appropriations for the Restoration Center's Community-based Restoration Program began in earnest in 1996. Since then, appropriations have increased significantly and the program has funded more than 200 projects annually since 2002. With increased funding, the Community-based Restoration Program has been able to fund larger, more complex projects in greater numbers; has become more accountable, both in terms of environmental compliance and performance; and has developed better tracking and evaluation tools to report on performance. With sustained funding, the Community-based Restoration Program will continue to provide funding and first-rate technical expertise to partners, improve accountability through robust science-based performance measures, and expand the number of restoration projects in coastal communities around the country.

**March 2006**

#### **National Oceanic and Atmospheric Administration**

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Community-based Restoration Program  
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**[www.nmfs.noaa.gov/habitat/restoration](http://www.nmfs.noaa.gov/habitat/restoration)**

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#### **Photo Credits:**

Many of the photos in *Hands on Habitat: Celebrating 10 Years of Coastal Restoration* were taken by NOAA employees during the normal conduct of their NOAA activities. Their photographic talents and contributions to this publication are gratefully acknowledged. For additional photo credits, please see page 73.

# Partner Acknowledgements

NOAA's Community-based Restoration Program is reversing the trend of coastal habitat degradation with the help of many national and regional partners, whose enthusiasm, time, and commitment have provided essential support for more than 1,000 successful projects. NOAA's national and regional partners include:

*American Rivers*  
*FishAmerica Foundation*  
*California Coastkeeper Alliance*  
*California Conservation Corps*  
*Connecticut River Watershed Council*  
*Chesapeake Bay Trust*  
*Ducks Unlimited*  
*EarthCorps*  
*Gulf of Maine Council on the Marine Environment*  
*Gulf of Mexico Foundation*  
*Institute for Fisheries Resources*  
*Institute for Sustainable Forestry*

*Keith Campbell Foundation for the Environment*  
*Lower Columbia River Estuary Partnership*  
*National Association of Counties*  
*National Fish and Wildlife Foundation*  
*Ocean Trust/National Fisheries Institute*  
*Partners for Restoring Coastal Louisiana*  
*Pinellas County Environmental Fund*  
*Resources Legacy Fund*  
*Restore America's Estuaries*  
*The Nature Conservancy*  
*Tillamook Estuary Partnership*  
*Trout Unlimited*

In addition to these partners, NOAA provides direct funding to more than 500 organizations, and has collaborated with over 1,500 groups on restoration projects across the United States, Canada, and the Caribbean.

NOAA celebrates and thanks our partners for their critical involvement in these efforts to restore the habitats that are the foundation of our nation's living marine resources.





*NOAA's Community-based Restoration Program is dedicated to restoring the habitats that are the foundation of the nation's living marine resources.*

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# Introduction



## The Importance of Healthy Habitats

Habitat degradation is evident in every region, state, and territory of our nation's coastline, where more than 55 million acres of tidal wetlands have been destroyed since colonial times. In some areas, nutrient runoff has devastated up to 90 percent of underwater seagrass beds, and thousands of idle dams block the life-preserving passage of migratory fish.

Healthy ecosystems provide vital fish and wildlife habitat, help protect inland areas from erosion, and filter sediment and polluted runoff from watersheds. Community-based habitat restoration brings life back to degraded coastal ecosystems and instills stewardship values and environmental awareness in project participants.

## Restoration Begins in Our Own Backyards

Around the country, communities are restoring fisheries and wildlife habitat with financial and technical assistance from the National Oceanic and Atmospheric Administration's (NOAA's) Restoration Center. Since 1996, the Restoration Center's Community-based

Restoration Program has funded more than 1,000 on-the-ground restoration projects in 27 states, Canada, and the Caribbean. Support from technical staff at 16 NOAA offices around the country helps ensure project success.

## Empowering Communities for Project Success

A model program for community collaboration, partnership building, and interagency cooperation, NOAA's Community-based Restoration Program partners with grassroots organizations to encourage hands-on citizen participation in restoration projects. This participation builds coalitions of interested citizens and fosters long-term stewardship of the nation's coastal and marine resources.

*Community-based habitat restoration brings life back to degraded coastal ecosystems and instills stewardship values in project participants.*

Under a competitive review process, the program awards millions of dollars to national and regional partners and local grassroots organizations every year. NOAA works closely with its grantees to implement sound coastal restoration projects and evaluate their success.

## The Community-based Restoration Model

The Community-based Restoration Program is a model that

- Uses federal funding and technical expertise to catalyze community-driven priorities.
- Employs staff with special technical skills to help improve project design, ensure environmental compliance, and advance restoration techniques.
- Provides educational opportunities and promotes environmental stewardship through hands-on participation.
- Helps leverage community funds and services to further enhance restoration projects.

Since 1996, the Community-based Restoration Program has created a host of national and regional partnership agreements and collaborated with more than 1,500 organizations. The program also

- Contributed nearly \$50 million to grassroots restoration projects, often generating 3 to 5 times as much in non-federal cash and in-kind contributions.
- Funded more than 1,000 projects.
- Engaged 100,000 volunteers, resulting in 630,000 volunteer hours worked on projects across the nation.
- Restored 24,000 habitat acres, removed over 100 stream blockages, and opened 900 stream miles for fish passage.

“NOAA’s Community-based Restoration Program links our national priorities to restore coastal habitats with our need to engage and educate the public through stewardship crucial to revitalizing their own communities. This double return on public investment makes the Community-based Restoration Program a shining star in NOAA’s constellation of essential programs aiding our nation and our natural world.”

**Mark Wolf-Armstrong**

*President and CEO, Restore America’s Estuaries*

### Contributing to a Healthy Economy

Coastal habitats — such as salt marshes, rivers and upland streams, coral reefs, oyster reefs, and mangroves — provide ecological benefits and also contribute to a healthy economy. Between 85 and 95 percent of commercial and sport fish spend a portion of their lives in estuaries, and coastal fishing industries supply more than 28 million jobs annually.





*Restore*

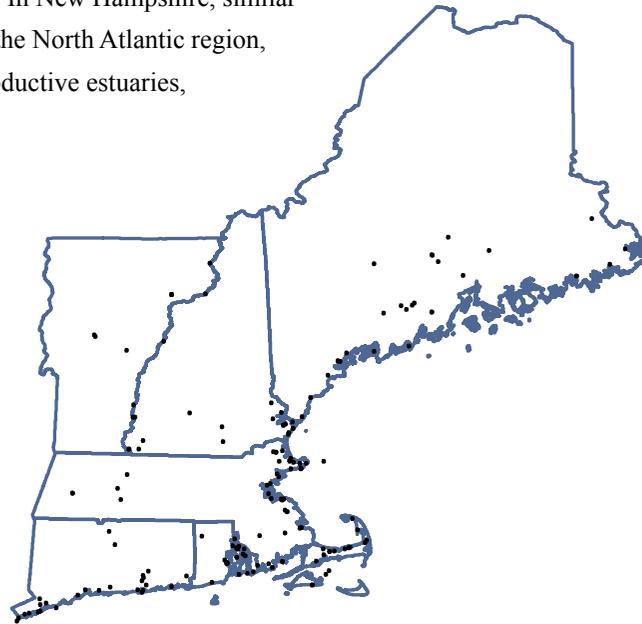
coastal and marine habitat

# North Atlantic Projects

Along the North Atlantic coast — one of the most biologically rich areas on the planet — tidal restrictions, in-stream barriers, invasive species, and poor water quality threaten vital marine and coastal resources. An estimated 10,000 dams in New England block migratory fish from reaching their historic spawning grounds. Many of these failing dams no longer produce the benefits for which they were built and can cause significant environmental harm by blocking fish passage, reducing water quality, and disrupting the natural flow of sediments in the river.

The region's rich salt marshes and shellfish and seagrass beds help filter sediment and pollution from coastal waters, but these resources are under threat. In Rhode Island, bay scallops and native oysters have largely disappeared because of pollution, disease, and overharvest. In New Hampshire, similar factors have decimated 40 percent of native seagrass beds. Throughout the North Atlantic region, undersized and crushed culverts choke the flow of saltwater to once-productive estuaries, eliminating native plants and restricting fish access. Without adequate tidal exchange, invasive, non-native plants take over coastal areas and the estuarine fish on which species of economic value feed can no longer survive there.

NOAA's Community-based Restoration Program works with local residents and state and federal governments to restore marine, estuarine, and riverine habitats in the North Atlantic region. NOAA technical staff work directly with grantees to develop projects and ensure their success. Local partnerships help garner community support and provide volunteer opportunities for future environmental stewards.



NOAA's Community-based Restoration Program has worked on a variety of restoration projects throughout the North Atlantic region (see map). Projects have removed barriers to migrating fish (above), reflooded salt marshes (below), reestablished shellfish populations, and improved the natural flow of rivers (facing page).



## MAINE



### GARDINER, ME

Along the rivers flowing into the Gulf of Maine, nearly 5,000 dams prevent or inhibit migratory fish from reaching vital spawning and rearing habitat. Anadromous fish, such as Atlantic salmon and river herring (above, left), spend their lives in salt water and move into freshwater to spawn. Conversely, eels spend their juvenile years in freshwater rivers before returning to the sea to spawn and die.

In 1761, the first dam was built along the Cobbosseecontee Stream, a large tributary of the Kennebec River. This dam — the Paperboard (above and facing page) — completely blocked migratory fish from reaching their spawning and rearing habitat. By the mid-1800s, eight dams restricted the 16-mile long Cobbosseecontee Stream. In 2000, only three dams remained, including the Paperboard Dam that still prevented fish passage into the upstream freshwater reaches of the Cobbosseecontee.

Through partnerships with the National Fish and Wildlife Foundation and Trout Unlimited, NOAA provided funds to remove the Paperboard Dam to open passage for fish such as Atlantic salmon, American shad, blueback herring, alewife, and American eel. Removal of the lowermost dam along the Cobbosseecontee will allow for future fish passage projects at the two remaining upstream dams (left).

MAINE



## NEW HAMPSHIRE



“The restoration partnership between the Gulf of Maine Council and NOAA has helped us focus on the most important projects throughout the Gulf of Maine watershed. The riverine, estuarine, and coastal ecosystems that are so important to the overall health of the region don't recognize arbitrary political boundaries!”

Don Hudson

Chair, Gulf of Maine Council on the Marine Environment



## NEW HAMPSHIRE



### CONTOOCCOOK RIVER, NH

Barriers on all but the smallest of New Hampshire's streams and brooks prevent migratory fish from reaching riverine habitat important during various stages of their lifecycles. The 18-foot-high West Henniker Dam blocked passage along a large reach of the Contoocook River (above). Although dams farther downstream acted as a barrier for some species, American eel were able to pass these obstacles, only to be blocked from swimming farther upstream by the Henniker Dam. The dam also separated populations of stocked Atlantic salmon fry and provided refuge for larger predators, such as bass, which fed on the fry.

In summer 2004, NOAA provided funding and technical support to help the town of Henniker remove the dam (facing page and right). The removal opened up a 15-mile stretch of river to American eel migration and reconnected populations of Atlantic salmon. Along with providing fish passage, the dam removal improved access to this scenic river for anglers and paddlers, and provided an opportunity for the local community to learn about the benefits of dam removal.



## VERMONT



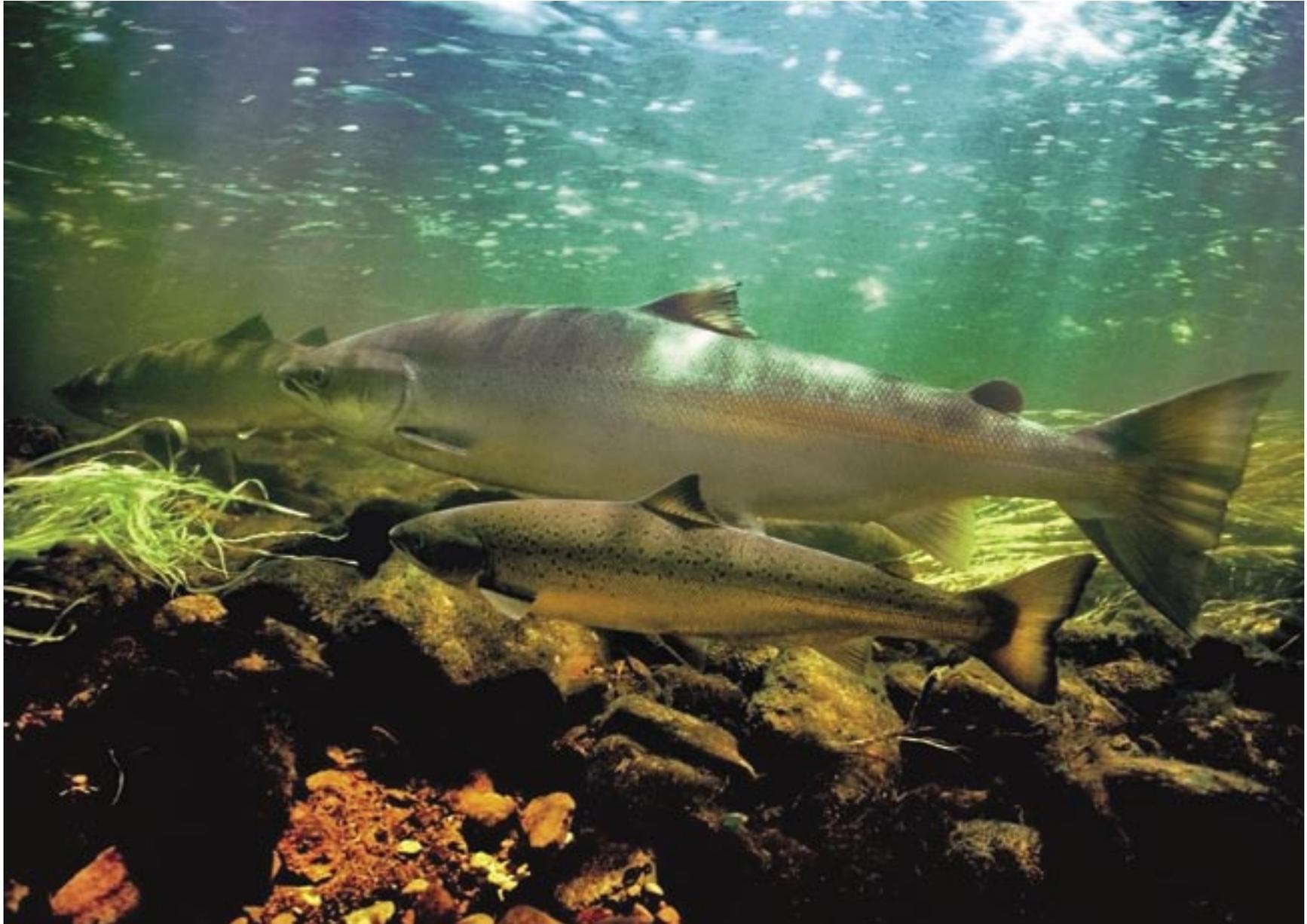
### ST. JOHNSBURY, VT

Migratory fish swim upstream great distances to reach important riverine habitats, even to rivers far from the coast. In Vermont, anadromous fish such as Atlantic salmon (facing page) spawn in rivers and streams after migrating up the Connecticut River. Unfortunately, many of these important migratory routes have been degraded by human activities. A section of the Sleeper's River (above), located in the Connecticut River watershed, was affected by construction of Interstate 91 in St. Johnsbury, Vermont. The river was straightened and channelized, reducing habitat and impairing passage for migratory fish. The vegetated buffer zone next to the river was also cleared, which caused more sediment to erode from the banks into the river.



Through its partnership with FishAmerica Foundation, NOAA provided funding for multiple phases of a project to restore stretches of the Sleeper's River. From 2002 to 2005, the Vermont Leadership Center led students and community volunteers in planting a 50-foot-wide buffer zone on both sides of the river with native saplings and willow shoots (left). The vegetated buffer zone increased riparian habitat along the river banks and improved fish habitat in the river by decreasing shoreline erosion, filtering pollutants from stormwater runoff, and providing shade over the river to cool water temperatures.

VERMONT



## MASSACHUSETTS



## MASSACHUSETTS



### BARNSTABLE, MA

Coastal marshes support a wide variety of fish and wildlife, contribute greatly to an area's biodiversity, and provide economic benefits through tourism and commercial and recreational fishing. However, 50 percent of tidal wetlands in Massachusetts have been degraded by tidal restrictions and fill placement, leading to decreased salt marsh functioning and reduced habitat available for the fish, crabs, and mammals that depend on tidal marshes. Two undersized culverts in Barnstable cut off tidal flushing to 40 acres of adjacent salt marsh, causing serious declines in local habitat quality.

NOAA's Community-based Restoration Program provided support for the Bridge Creek Salt Marsh Restoration Project, a multiyear initiative involving over 30 local, state, federal, and private project partners. The complex effort required closing a state road and an active railroad (facing page) to replace the two undersized culverts with larger concrete box culverts. These new, 10-foot-wide culverts (above) increased tidal flow to the marsh, benefiting the salt marsh plants and animals in this state-designated Area of Critical Environmental Concern (right).

“NOAA's Community-based Restoration Program takes a realistic approach to fisheries management by restoring the habitat that is vital to our commercial and recreational fisheries.”

John Bell

Mayor, City of Gloucester, Massachusetts



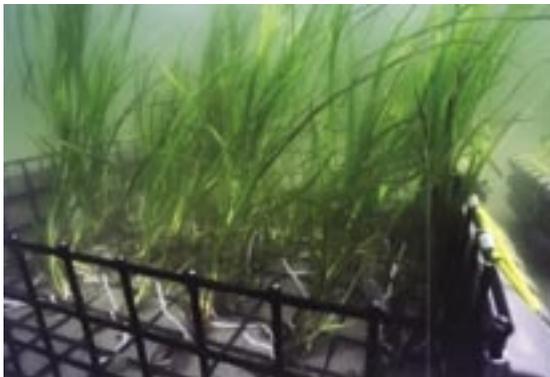
## RHODE ISLAND



### NARRAGANSETT BAY, RI

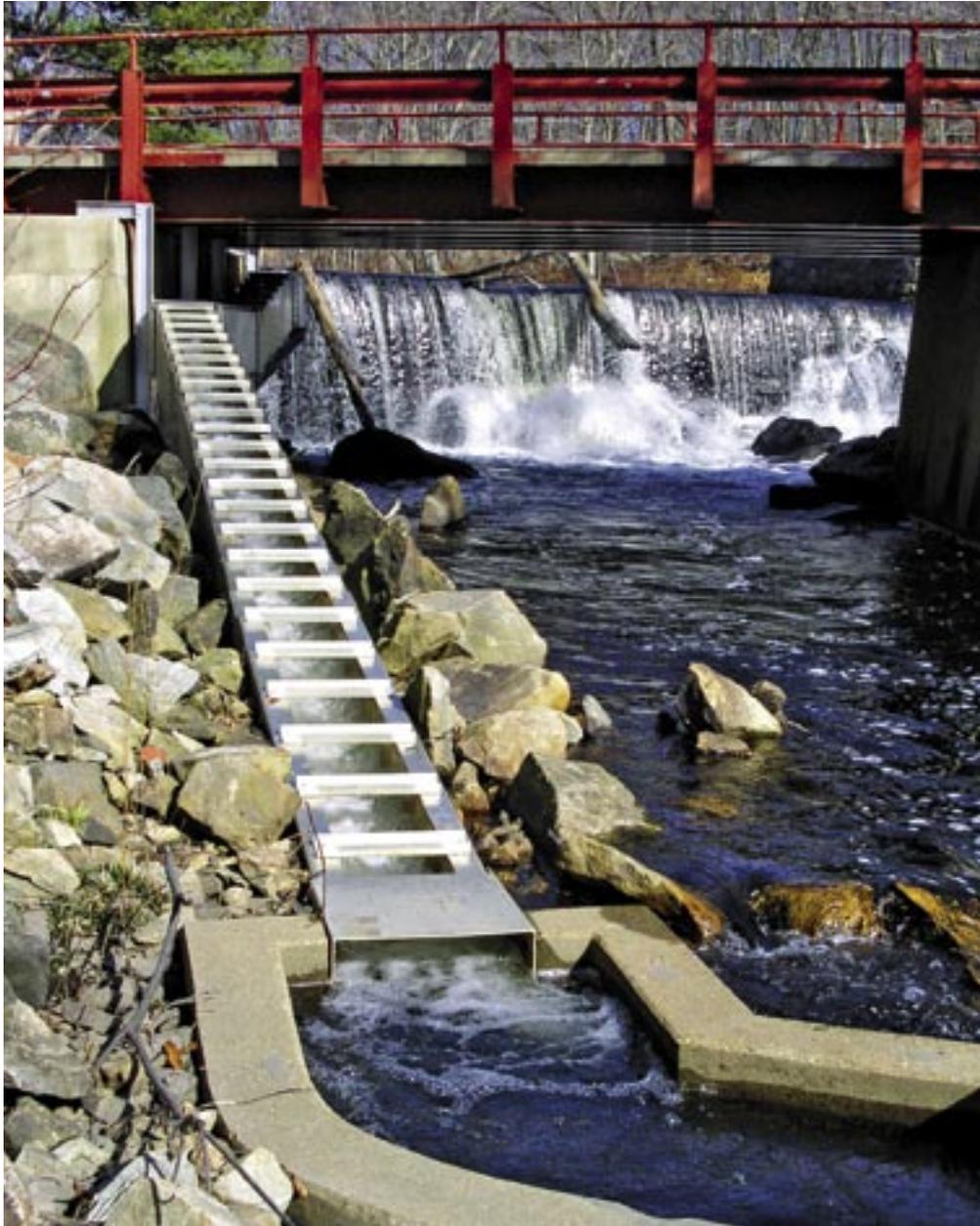
Eelgrass beds provide nursery, foraging, and spawning habitat for many types of finfish and shellfish, including several commercially and recreationally valuable species. Eelgrass also filters sediment from the water column and dampens storm waves, providing shoreline protection. However, throughout the past century, eelgrass beds in Rhode Island's Narragansett Bay have been damaged by disease and storms. In addition, poor water quality associated with coastal development and increasing water temperatures have contributed to eelgrass decline. Excess nutrients in the warmer waters promote plankton blooms, blocking essential light from reaching the eelgrass. The Bay once supported thousands of acres of eelgrass beds, but today, less than 100 acres remain.

NOAA has supported Save the Bay and other restoration partners to implement large-scale, volunteer-based programs to restore Narragansett Bay's eelgrass beds. Save the Bay uses a variety of techniques, including hand transplants and temporary frames (above and left), in which volunteers collect live plants from donor beds throughout the Bay, attach plants with biodegradable twist ties to the frames, and place the frames on the Bay bottom. After the shoots become rooted in the sediment, the frames are removed and the plants are left to grow and propagate. The organization also works with local schools to raise plants, select transplant sites, and evaluate eelgrass transplant success (facing page). As of 2005, Save the Bay had restored 27 acres of eelgrass in Narragansett Bay.



RHODE ISLAND





*“Providing fish passage not only enhances migratory river herring populations, it also helps striped bass, herons, osprey, fisher, and other animals throughout the Eightmile River watershed that feed on these smaller fish.”*

Linda B. Bireley  
 Project Officer and Vice President,  
 Lyme Land Conservation Trust

#### EIGHTMILE RIVER, CT

On the Eightmile River in Connecticut, a dam at Ed Bill’s Pond blocked species such as river herring and Atlantic salmon from swimming upstream to reach important spawning habitat. In 1999, NOAA joined local, state, and federal partners to construct an Alaskan steep-pass fishway (left), an aluminum channel with baffles that help slow water so that migratory fish can swim up the structure to reach upstream habitat. Volunteers and state biologists operate the fishway during the migratory period, perform any necessary maintenance, and monitor the fish runs annually.

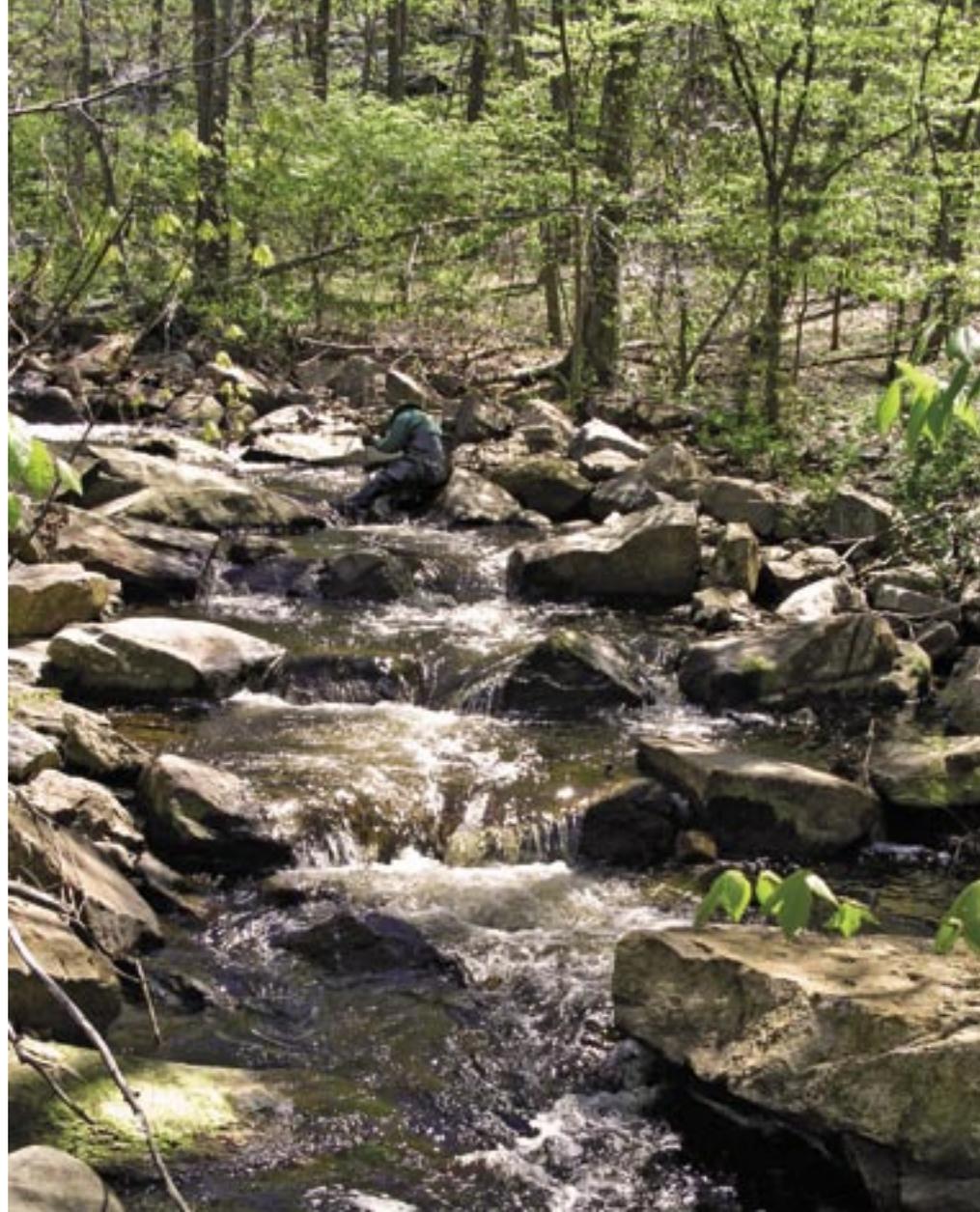
Atlantic salmon, sea lamprey and other diadromous and resident fish are using this innovative fishway. The project complements other restoration work, such as dam removal in the watershed, conducted jointly by NOAA, The Nature Conservancy, the State of Connecticut, and other organizations. Combined, these restoration efforts will enhance the ecological and social importance of the Eightmile River, nominated for status as a federal Wild and Scenic River.



### LOWER GUILFORD LAKE, CT

In another Connecticut fish passage project, the Guilford Lakes Improvement Association, with support from NOAA, American Rivers, and the Connecticut Department of Environmental Protection, constructed a bypass channel around the Duffield Dam in Guilford. Designed like a natural stream bed, the bypass channel was created by breaking up and repositioning bedrock to construct a series of pools and steps (right) connecting the river below the dam to the lake above. Fish, such as alewife (above) can then move from pool to pool and make their way up the fishway to their freshwater spawning habitat in Lower Guilford Lake.

NOAA's Community-based Restoration Program is working cooperatively with the U.S. Geological Survey to monitor and assess alewife passage through the bypass. Results of their assessment will be used to make recommendations to improve fish passage at the site, if needed, and will provide important information for the design of future bypass channels in this region and elsewhere.





Thousands of student and adult volunteers commit personal time to restore Mid-Atlantic region habitats (above, below, and facing page). Involvement in NOAA projects (see map) instills an environmental ethic and strengthens stewardship values in project participants.

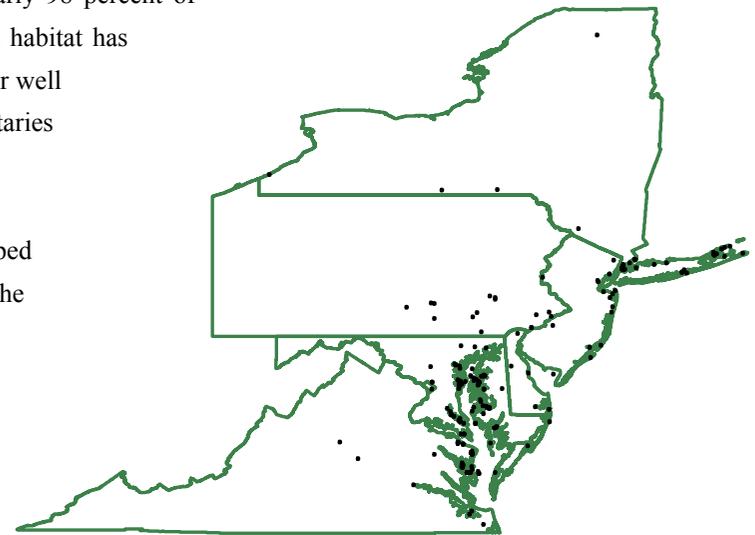


# Mid-Atlantic Projects

The Mid-Atlantic region supports productive and diverse ecosystems including the Hudson-Raritan Estuary, the Delaware Estuary, and the Chesapeake Bay. These ecosystems provide nursery, foraging, shelter, and spawning habitats to many of the region's fisheries and support complex food webs along the East Coast of the United States.

Industrial contamination, agricultural runoff, development, river barriers, and the loss of upstream migratory fish habitats have all contributed to habitat loss in the Mid-Atlantic region. Commercial and residential development has significantly decreased the amount of coastal wetlands, which are among the most productive habitat types in the world. In Virginia alone, 30 percent of historic coastal wetlands have been lost due to development, sea level rise, impoundments, and dredging. Seagrass beds and oyster reefs, which provide homes for numerous marine species and help filter sediment and nutrients from the water column, have also declined significantly. Throughout the Mid-Atlantic region, disease, overharvesting, and pollution have decimated nearly 98 percent of historic oyster populations. Coastal and upstream fisheries habitat has also been impacted by the construction of stream barriers for well over two centuries — nearly all of Pennsylvania's river tributaries possess barriers to fish migration.

In the Mid-Atlantic region, NOAA staff have developed strong partnerships with local organizations to tackle the region's habitat issues. From coastal marsh and native shellfish restoration to dam removals and stream bed improvements, NOAA has made significant strides to recover degraded habitat and involve residents in on-the-ground habitat restoration.





Empower local  
*communities*

NEW YORK



## NEW YORK



### GREAT SOUTH BAY, NY

Healthy salt marshes provide multiple benefits for surrounding areas, including storm surge protection, wildlife habitat, and runoff filtration, as well as nursery areas and foraging habitat for shellfish and finfish. Coastal development around Beaver Dam Creek, a once-productive salt marsh located on the Great South Bay, has increased the spread of invasive plant species and impaired critical salt marsh functions.

The NOAA-supported Beaver Dam Creek Wetland Restoration project is a comprehensive effort to restore 30 acres of degraded wetland along Long Island's South Shore (above). The project's first phase restored 8 acres of vital estuarine habitat by regrading the project site, constructing tidal creeks and pools, and reestablishing native salt marsh plant communities. School groups, senior citizens, and local residents helped execute the project by planting native grasses (right), and installing fencing to exclude foraging geese from the newly planted salt marsh (facing page). In total, nearly 200 volunteers participated in this wetland restoration project over a 2-year period.



## NEW JERSEY



*“As a science educator, my mission is to expand teaching and learning beyond the classroom to stimulate awareness of the necessity for conserving and protecting the environment. Oyster gardening has truly encouraged my students to become environmentally conscious individuals.”*

**Doreen Silakowski**

*Science Teacher, Henry Hudson Regional School*

### HUDSON-RARITAN ESTUARY, NJ

Over the past century, American oyster populations have declined dramatically along the East Coast of the United States. In an effort to bolster oyster populations, the NOAA-supported NY/NJ Baykeeper implemented a three-pronged restoration approach that included improving water quality, creating oyster reef habitat, and involving and educating the community about oyster restoration and ecology.

The NY/NJ Baykeeper Oyster Restoration Project uses oysters grown in aquaculture facilities and through a volunteer-based oyster gardening program. Oyster gardening workshops provide hands-on training for students and adult volunteers in oyster restoration techniques. Participants build floats (above, left) to hold bags of baby oysters growing on hard clam shells (above right and facing page). Oysters are grown in these floats at various locations in the Hudson-Raritan estuary, and are later planted on reefs created throughout the area.

Since the oyster program's inception in 2000, NY/NJ Baykeeper has involved more than 600 volunteers contributing nearly 9,000 hours of time. Volunteer oyster gardeners have planted more than 100,000 seed oysters at several sites in coastal New York and New Jersey.

NEW JERSEY



PENNSYLVANIA



## PENNSYLVANIA



### READING, PA

Although the town of Reading sits 110 miles from the ocean, the anadromous fish that use adjacent Wyomissing Creek need both saltwater and freshwater to survive. The fish travel from the ocean to small freshwater tributaries to reach upstream spawning habitats. Newly hatched young use the upper reaches of the river as a nursery before returning to the ocean to complete their life cycles. After 80 years of blockage by small dams (above, left), Wyomissing Creek is now two steps closer to becoming a free-flowing stream again.

With NOAA support, the Reading Public Museum hired bulldozers and other machinery to remove two small dams on museum property. Following the dam removals, crews worked midstream to recenter the channel, smooth out the stream banks, and position boulders for additional riffle habitat (above, right). The crews also planted a riparian forest buffer of native plants along both banks to create shade, reduce sediment from runoff, and provide additional wildlife habitat. The project restored nearly 1,800 linear feet of stream reach and opened up approximately 6 miles of spawning and rearing habitat (facing page) to migratory fish. The restored area and adjacent parkland also provide new educational and recreational opportunities for museum staff, teachers, school groups, and gardening clubs. As a result of the success of the Wyomissing Creek restoration project, another upstream dam is now targeted for removal and will provide an additional two miles of fishery habitat.



## DELAWARE

“Migratory fish are becoming an excellent “poster species” for generating excitement in the river and restoring its fuller biological capacity. With the potential for sportfishing and shad festivals, there is even hope for a significant contribution to the urban renewal of Wilmington through these river restoration projects. It is remarkable how quickly virtually everyone presented with this story grasps its importance.”

Robert Lonsdorf  
Senior Planner, Brandywine Creek Conservancy



### BRANDYWINE RIVER, DE

One of the largest tributaries of the Delaware Estuary, Brandywine River historically supported American eel (facing page), as well as large runs of American shad and other anadromous fish. However, the Brandywine Valley’s elevation has also made it an excellent site for industrial mills, and in the early 1900s a series of 11 dams (above and left) were built to power these mills. The dams, many of which are now defunct, prevent fish from reaching upstream spawning habitat. A recent report noted that the 15-mile Delaware stretch of the Brandywine River could support up to 25,000 American shad if passage were provided for these migratory fish.

To evaluate the feasibility of restoring historic fish passage at all of the Brandywine River dams, NOAA funded a study to examine the associated technical, legal, fiscal, environmental, and social issues. The study revealed it would be technically feasible to provide fish passage at each of the dams along the river, and plans are now underway to remove three of the dams and build fishways at another two. Eventually, migratory fish will again be able to move unimpeded throughout the Brandywine River corridor. The completion of this study depended on partnerships between key governmental agencies, dam owners, and other participating organizations. In addition, providing fish passage at all the dams would open up over 15 miles of habitat to migratory fish, and improve water quality and wildlife habitat throughout the Brandywine River corridor.

DELAWARE



## MARYLAND



### U.S. NAVY WEBSTER FIELD ANNEX, MD

In 2002, NOAA's Community-based Restoration Center partnered with the Alliance for Chesapeake Bay and the U.S. Navy to restore coastal habitat on the 1,000-acre Webster Field Annex on the upper St. Mary's River in Maryland. This "living shorelines" project accomplished the Navy's objective — to protect the shoreline from erosion — using stabilization techniques that also benefit NOAA trust resources. Instead of installing hardened breakwaters, the Navy stabilized the shoreline with native wetland plants (above and left), built an offshore oyster reef, and planted underwater bay grasses to reduce wave energy. These natural stabilization techniques help prevent erosion while providing vital habitat for nearshore fish species. The highly successful partnerships formed as part of this project earned it a prestigious Coastal America Award in 2004.

The following year, NOAA held its annual Restoration Day at the Webster Field restoration site to supplement the existing project. Over 100 staff members planted 50 trays of underwater grasses (facing page) grown in tanks in NOAA offices, installed 5,400 wetlands plants, and placed 100 bags of native oysters on an offshore reef. The combined Webster Field projects will help restore over 2,000 feet of eroding shoreline.

MARYLAND



DISTRICT OF COLUMBIA



## DISTRICT OF COLUMBIA



### ANACOSTIA RIVER, WASHINGTON, DC

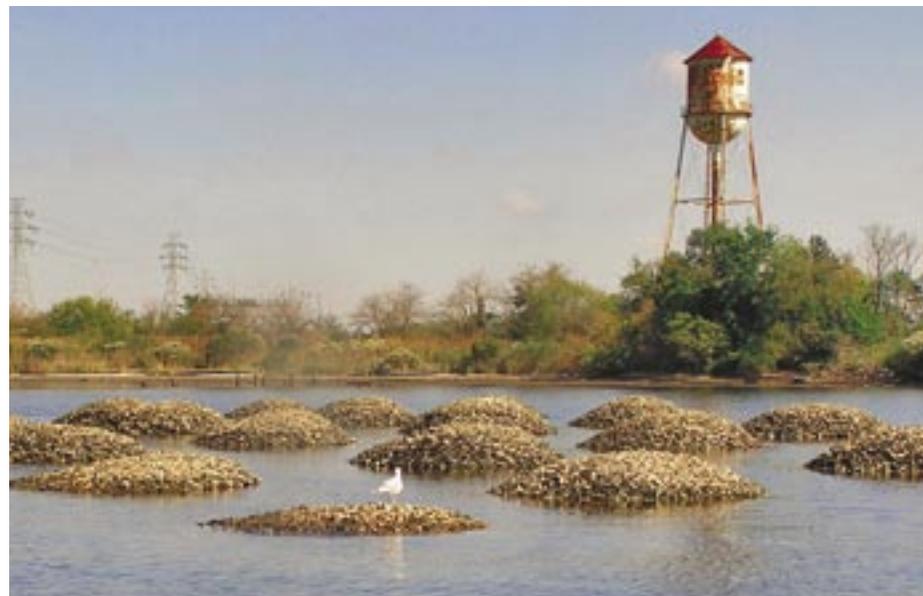
The Anacostia River flows through the heart of Washington, DC, on its way to the Potomac River, Chesapeake Bay, and, finally, the Atlantic Ocean. The river and its tributaries (facing page and right), rising and falling with the tides, support an array of marine, estuarine, and freshwater fish, including striped bass, shad, perch, and herring. The Anacostia River also provides important habitat along a migration corridor for many birds, including geese and herons.

Although the Anacostia River is a rich natural resource, it has been degraded by the concentrated development along the river's entire length. Pollution has destroyed historic fishing and made river water unsafe for both fishing and swimming. Every year, 20,000 tons of trash end up in the Anacostia River.

NOAA's Community-based Restoration Program supports programs throughout the Anacostia watershed to address some of these environmental problems and increase awareness of this important resource in the nation's capital. Students from DC area schools learn about the importance of the Anacostia River in the classroom and then conduct hands-on restoration, including trash removal (above, left) and wetland planting (above, right). NOAA is also engaged in efforts to remove river barriers and provide fish passage at existing dams throughout the watershed. Through a combination of education and active restoration, the Anacostia River can be restored to a healthy functioning ecosystem and a national treasure.



## VIRGINIA



### ELIZABETH RIVER, VA

Oyster reefs support diverse populations of finfish, crabs, and other estuarine animals by providing important three-dimensional habitat for foraging and protection from predation. The reefs also offer essential settling surfaces for young oysters and maximize spawning efficiency by bringing male and female oysters closer together. The oysters also improve the health of the nearby environment, filtering the surrounding water and buffering wave energy to prevent shoreline erosion.

Unfortunately, harvesting pressures, oyster diseases, and poor water quality have significantly reduced native oyster populations in the Chesapeake Bay, which are currently at only 1 percent of their historic levels. NOAA has funded several oyster reef restoration projects on the Elizabeth River, a tributary of Chesapeake Bay. At one site, the Elizabeth River Project and the Chesapeake Bay Foundation joined with the Virginia Marine Resources Commission to rebuild an oyster reef. Local middle and high school students helped oyster gardeners grow more than 100,000 seed oysters in floating cages, then plant the oysters on reconstructed reefs (above). Establishing these reefs has increased the spat set (the number of young oysters settling on older oyster shells, left), bolstering the area's oyster population.

## VIRGINIA



### NEW GOSPORT, VA

The New Gosport Landfill is located along Paradise Creek, a tributary of the southern branch of the Elizabeth River in Portsmouth, Virginia. From the late 1960s to early 1970s, tons of abrasive sandblast waste, contaminated soil, and paint chips from the Norfolk Naval Shipyard were disposed of in the landfill, causing heavy metal contamination and concerns about human and environmental health. The remediation of the New Gosport Landfill site involved removing 55,000 tons of sandblast waste and other contaminants to improve local environmental conditions. Project planners filled the area with clean soil, then planted the area with wetland vegetation.

NOAA personnel provided critical technical assistance for the New Gosport Landfill restoration project, which included surveying biological benchmarks from adjacent marshes, developing the grading and planting plan for the new marsh, and assisting with construction oversight. The combined efforts resulted in the creation of 1.9 acres of tidal wetlands (above) on the site of the former landfill. These wetlands help filter stormwater before it flows into the river and into Chesapeake Bay, and provide important habitat along the banks of Paradise Creek for species such as striped bass, red drum, blue crabs, silver perch, summer flounder, killifishes, silversides, and spot and white perch.

*“Oysters are now striking on every piling, up and down the Elizabeth River! What a fantastic outcome of NOAA’s restoration support.”*

**Marjorie Mayfield Jackson**

*Executive Director,  
The Elizabeth River Project*



*Advance*

restoration science

# South-Atlantic and Caribbean Projects

From the coastal wetlands of North Carolina to the coral reefs of the Caribbean Sea, the coastal habitats of the South Atlantic region are as diverse as the fisheries they support. Wetland marshes, oyster beds, mangrove systems, and coral reefs are just a few of the valuable coastal habitats that support an array of commercial and recreational species, such as blue crabs, grouper, and tarpon.

Much of the South Atlantic region is characterized by estuarine habitat, which provides critical nursery areas for commercially valuable species. Approximately 94 percent of the commercial fish and shellfish harvested along the southeast Atlantic coast depend on estuarine ecosystems for survival during some part of their life cycles, and the region's economic health is heavily dependent on commercial and recreational fishing industries. Despite the valuable contribution to the nation's fisheries, habitats of the South Atlantic region have suffered significantly from coastal development. North Carolina and Florida are estimated to have lost approximately half of their original wetlands acreage. Habitat destruction has become one of the primary threats to the health and survival of many of the South Atlantic region's valuable fisheries.

In the South Atlantic region, NOAA works with communities from North Carolina to Puerto Rico to restore fish habitat through community-led restoration projects. Partnerships forged under the Community-based Restoration Program will continue to encourage the restoration and protection of our coastal habitats and will build stewardship values in future generations.



NOAA projects in the South Atlantic region (see map) undergo careful monitoring to evaluate project success. In Florida, for example, NOAA scientists put non-toxic dye in the water to track tidal flows (facing page). Monitoring also measures benefits to local resources (above and below).



## NORTH CAROLINA



### NORTH RIVER FARMS, NC

The North River in Carteret County, North Carolina, once supported an abundant and healthy supply of oysters. Coastal wetlands, including those along North River, provide fish and wildlife habitat and filter runoff entering local waterways, which supports the area's oyster populations. However, as wetlands adjacent to the river were converted to agricultural use, surface runoff containing high levels of bacteria, sediments, and nutrients combined with abnormally high influxes of freshwater to decimate nearby oyster beds. In the past 100 years, North Carolina's oyster population has declined by more than 90 percent.

NOAA's Community-based Restoration Program is helping restore the historic wetlands at North Rivers Farms, a 6,000-acre farm (left) acquired by the North Carolina Coastal Federation. Contracted crews used large machinery to regrade and reshape the landscape to allow for more natural water flow. Volunteers began planting native species (above) in 2003, an effort that will continue for several years, returning this area to a functional wetland that will support the regeneration of local oyster populations and rehabilitate these valuable coastal wetlands.

## NORTH CAROLINA



### DUKE UNIVERSITY MARINE LAB, NC

Shorelines armored with hardened structures, such as bulkheads and seawalls, can increase the rate of coastal erosion, restrict or eliminate natural sediment transport processes, and leach toxic chemicals from the structures into surrounding waters. These impacts greatly degrade estuarine habitats — an unfortunate situation, given that more than 65 percent of the fish species caught in North Carolina by recreational fishermen depend on the state’s 2.1 million acres of estuaries at some point in their life cycles.

To minimize these adverse impacts, NOAA’s Community-based Restoration Program and Restore America’s Estuaries have joined with the North Carolina Coastal Federation to fund natural shoreline restoration projects. One of these projects, located at the Duke University Marine Lab, removed 260 feet of degraded asbestos bulkhead, restored more than 700 feet of marsh along Bogue Sound (above and right), and created a viable oyster reef just offshore. Together, these projects create a natural system that buffers the shoreline, preventing coastal erosion and providing important habitat for fish and shellfish.



## SOUTH CAROLINA



### SANDPIPER INLET, SC

The tidal mud flats in Sandpiper Inlet, located in Huntington Beach State Park, historically supported a diverse estuarine community, including large populations of blue crab, brown shrimp, spot-tail bass, and shorebirds (above). Over a decade ago, several factors contributed to the blockage of the inlet (left, top), and subsequent ecological conditions caused a devastating fish kill during the summer of 1993. In 2005, South Carolina State Park built a 250-foot-wide inlet (left bottom and facing page) reestablishing tidal flow between Sandpiper Pond and the ocean, and restoring approximately 35 acres of coastal wetlands.

As a partner in the Sandpiper Inlet restoration, NOAA's Community-based Restoration Program provided funds for scientific research and education activities. Faculty and students from Coastal Carolina University and local volunteer groups are rigorously monitoring changes to water quality, fisheries, vegetation, and birds at the project site. These observations will help verify the gradual return of healthy estuary function and provide important information to the field of restoration science. This monitoring, coupled with educational activities such as an audio-visual exhibit at the park interpretive center, have been a huge success, creating a sense of stewardship among project volunteers and the thousands of visitors to Huntington Beach State Park each year.

*“Coastal ecosystem restoration is important not only for the environmental benefits these projects provide, but also for the sense of optimism it gives citizens – that we can recover from past mistakes.”*

**Dana Beach**

*Executive Director, South Carolina Coastal Conservation League*

SOUTH CAROLINA



GEORGIA



## GEORGIA



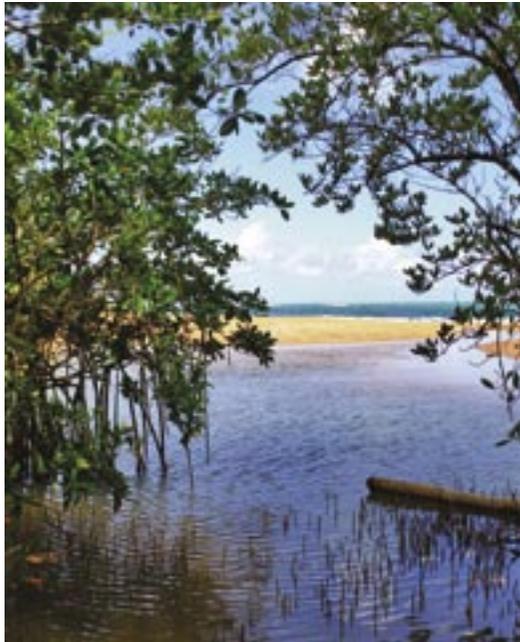
### SAVANNAH, GA

Overharvest, pollution, and disease have all contributed to declining oyster populations in Georgia, factors exacerbated by the practice of not returning shells to the ocean after harvest. Because oyster production depends on the availability of substrate or shell material for baby oysters to settle upon and grow, the constant long-term removal of shell has been a major contributor to declining populations. Annual fisheries statistics show a downward spiral for Georgia oyster landings, from nearly 7 million pounds a century ago, to just over 7,000 pounds today.

To combat this problem, NOAA funding helped set up the GEORGIA project (Generating Enhanced Oyster Reefs in Georgia's Inshore Areas), which began in Savannah and has since expanded to Georgia's entire coast. The project recycles shells donated from restaurants and local oyster roasts (facing page) to construct new oyster reefs (above and right), and also includes an extensive public education campaign that describes shell recycling and its benefits to oyster reef restoration.



## FLORIDA



### MATHESON HAMMOCK, FL

Matheson Hammock, an 832-acre park, is home to the last mangrove forest in urban Miami-Dade County, a county devastated by Hurricane Andrew in 1992. Prior to the hurricane, these mangrove wetlands (left) served as high-volume feeding, breeding, and spawning habitat for anadromous fish, baitfish, and sea turtles. The park's tidal creeks offered migration habitat for horseshoe crabs and roosting habitat for wading birds. Manatees (facing page, bottom) and saltwater crocodiles have also been spotted in the mangrove-lined tidal creeks. After the hurricane, fallen trees and other debris clogged the tidal creeks and severely restricted tidal flow, cutting it off entirely in some areas.

Since 2001, NOAA has supported almost 50 acres of habitat restoration in Matheson Hammock. Over 150 volunteers have devoted some 7,100 hours to unclog tidal creeks and remove debris in cross corridors (above and facing page, top). Volunteers used canoes to carefully remove dead, decaying, and non-native trees such as Australian pine, opening 3.9 miles of creek for black mullet, fantail mullet, and snapper.

## FLORIDA



*“NOAA is focused on restoring critical coastal ecosystems whose natural beauty and complexity can be regularly appreciated, indeed discovered, by our citizens. I applaud their extensive program that is substantially improving and preserving Florida’s precious and productive coastal environments.”*

**Dr. Peter Betzer**

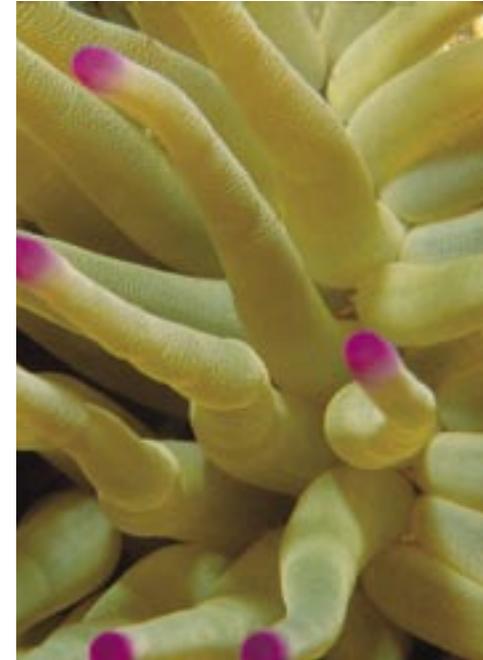
*Dean, College of Marine Science, University of South Florida*



CARIBBEAN



## CARIBBEAN



### VIEQUES, PUERTO RICO

Coral reefs support a tremendous diversity of marine life (right), but have declined dramatically over the past two decades due to increases in sediments and nutrients, rising sea temperatures, and damage caused by fishing gear and boat groundings. Staghorn coral, which once flourished in the waters off of Puerto Rico, has been particularly hard hit and was listed as a candidate species under the Endangered Species Act in 1999.

NOAA provided financial and technical assistance to the Puerto Rico Department of Natural and Environmental Resources (PRDNER) to help stabilize a reef off the coast of Vieques Island that was damaged when a ferry ran aground. The assistance included state-of-the-art, on-the-job training for PRDNER staff to reattach 100 coral fragments using underwater cement (above).

NOAA has also supported groups in the Caribbean to assess changes in coral condition, train volunteer divers in coral aquaculture, and conduct research on techniques for repairing reefs and transplanting corals. Other projects in Puerto Rico and the Virgin Islands have focused on protecting and restoring seagrass habitat and mangrove forests. These habitats, degraded due to urbanization and decreased water quality, are important areas for manatees, shorebirds, moray eels (facing page), as well as a variety of other reef fishes and invertebrates.



# Gulf of Mexico Projects



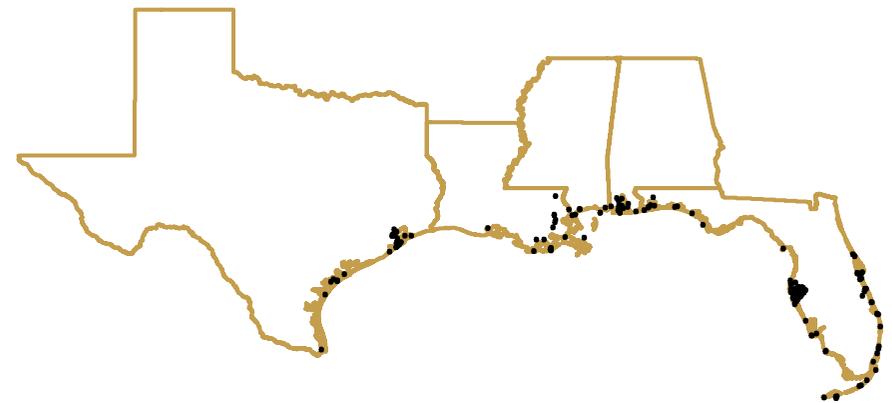
From marsh and seagrass restoration (above) to marine debris removal (below), NOAA's Community-based Restoration Program repairs habitat important to the Gulf Coast's commercial and recreational fisheries (facing page). Projects throughout the Gulf of Mexico region (see map) engage local communities and promote environmental stewardship.



The Gulf of Mexico supports some of the nation's most productive fisheries. In fact, the region hosts three of the top five fishing ports in the nation in terms of landings. These fisheries provide a wholesome food source for U.S. citizens, contribute to a robust economy, and support traditional fishing livelihoods. Healthy marine and coastal habitats are the foundation of the Gulf's fisheries production and help protect the shoreline and the nation's oil and gas infrastructure when storms threaten to erode coastal areas.

Land development, pollution, erosion, and loss of freshwater inflows have all contributed to habitat loss and degradation in the Gulf of Mexico region. Seagrass beds and oyster reefs, which provide homes for numerous marine species and help filter sediment and nutrients from the water column, have suffered from pollution and poor land management. In Alabama alone, half of the state's native oysters have disappeared in the past 100 years. Coastal wetlands, which are among the most productive ecosystems in the world, have also disappeared at an alarming rate in the Gulf of Mexico region, most notably in Louisiana, which loses 25 square miles of wetlands every year from natural subsidence and human impact.

In the Gulf of Mexico region, NOAA's Community-based Restoration Program meets local habitat restoration needs by partnering with grassroots organizations and state and federal agencies. From marsh and oyster reef creation to marine debris removal and hydrologic restoration, NOAA reestablishes crucial fisheries habitat and establishes a conservation ethic at the core of the region's citizenry by involving communities in local restoration projects.





Enhance natural  
*resources*

F L O R I D A





F O R T D E S O T O P A R K , F L

In 2004, tidal flow was restored between two lagoonal waterways of Ft. De Soto Park. Natural circulation was eliminated within the park’s lagoon-bay complex through the construction of causeways in the late 1950s and early 1960s. Without water from the Gulf of Mexico flowing into the lagoons, bay waters became stagnant, and temperatures rose — scientists recorded temperatures as high as 106 degrees during summer months. Dissolved oxygen levels plummeted and important seagrasses vanished.

To correct the problem, part of a causeway dike was replaced with a 40-foot span bridge (facing page). On the day tidal exchange was restored, scientists used nontoxic dye to observe the initial movement of the water between the lagoons (above, left). The restored water circulation is expected to improve water quality and the habitat value of 1,000 acres of productive lagoon area. Multiple fish and bird species (such as the reddish egret, above right) will benefit from the restored areas, capitalizing on the new habitat and prey available. Just three days after it was opened, a local fisherman landed a 33-inch snook off the new bridge — a sure sign that things are improving.

“As custodians of public resources, Pinellas County must manage these resources for the good of not only the people, but the natural systems as well. We hope the Fort De Soto project establishes a model for corrective measures to restore tidal flows in dredged and filled projects.”

Jake F. Stowers, C.E.P.  
Assistant County Administrator, Pinellas County, Florida

## A L A B A M A



### MOBILE BAY, AL

An estimated 10,000 acres of coastal wetlands have been lost in Alabama since the 1950s. Much of the loss is due to development, dredge and fill operations, and hardened shorelines. Fortunately, several projects in Mobile Bay have been able to restore and protect these rich coastal habitats.

The Mon Luis Island Marsh Restoration Project has restored five acres of salt marsh (above, right). This land at the mouth of Fowl River, which once served as a disposal site for dredge material, had become infested with invasive reeds (*Phragmites australis*) more than ten feet tall. Heavy machinery was used to remove the reeds and scrape down the soil. Following construction, volunteers planted the entire area with native marsh grasses. The grasses quickly colonized the restoration site, and daily tidal flooding has created a perfect home for hermit crabs and many other marine species (facing page).

At a separate project on Dauphin Island (above, left and center), small breakwaters protect the salt marsh against coastal erosion caused by boat wakes from personal watercraft, ferries, and small ships. The breakwaters were placed off-shore of the marsh to prevent further erosion and to encourage oyster reef formation. Oyster shell on such structures provides habitat for larval oysters to settle and grow in these intertidal areas (left).

A L A B A M A



MISSISSIPPI





**GULF COAST, MS**

Crab trap recovery is essential for enhancing habitat along the coastlines of Mississippi, Alabama, Louisiana, and Texas. Since the widespread use of crab traps began in the 1950s, derelict traps lost to storms, broken lines, and neglect have accumulated in the intertidal zone, marsh and offshore areas. Derelict traps can be found in sensitive ecosystems including oyster reefs, saltwater marshes, and tidal flats.

NOAA and the Gulf of Mexico Foundation have worked together since 2002 to fund the removal of over 15,000 derelict crab traps along the Gulf Coast. Project staff and local volunteers of all ages (facing page and above, left) routinely scout Gulf waters and remove lost traps to prevent habitat degradation. Removing derelict traps also protects aquatic vegetation from harm, reduces damage to boats, and protects a variety of animals such as shellfish, fish, and turtles from unintended entanglement (above, right).

“What example of success could trump this project? Recreational and commercial fishermen, state biologists, the crab industry, a regional state commission, and state and federal governments teamed up to do a good thing for the health of our coastal waters. That is more than success. That is the way all things should be handled.”

**Larry B. Simpson**  
Executive Director, Gulf States Marine Fisheries Commission



### VERMILION PARISH, LA

Habitat loss along the Gulf of Mexico coastline is one of the most urgent environmental threats facing the United States today, made evident by the massive devastation caused by Hurricane Katrina in late summer 2005. NOAA restores coastal wetlands that buffer storm waves, helping to protect human life and the nation's oil and gas infrastructure when devastating storms hit. These same wetlands support our marine resources, including large recreational and commercial fisheries.

Marsh within the Paul J. Rainey Wildlife Sanctuary, like much of coastal Louisiana, has eroded due to altered hydrology, subsidence, lack of sediment input, and high wave energy from storms. The Rainey Refuge restoration project — at the National Audubon Society's oldest and largest wildlife refuge — will help to restore a 640-acre shallow pond that was formerly vegetated marsh. The project used heavy equipment (above) to create 36,000 linear feet of earthen terraces and included the planting of 15,400 plugs of salt marsh grass. The terraces will help enable a more natural tidal flow as well as reduce wave erosion along the shoreline, and the plantings will provide an initial “boost” that will lead to long-term increases in submerged aquatic and emergent vegetation. This restored habitat will provide great benefits for fish, birds, and other wildlife along the Louisiana coast (facing page), as well as protect the wetlands that provide a storm buffer for energy facilities in the area.

## LOUISIANA



*“When a restoration project has clear environmental benefits and at the same time protects critical energy infrastructure for the country, it’s a win-win for everyone.”*

**Ted Falgout**  
*Executive Director, Greater Lafourche Port Commission*



T E X A S





**BROWNSVILLE, TX**

Tidal flooding of the Bahia Grande, an 11,000-acre estuary between Brownsville and Port Isabel, Texas, was impeded by the construction of the Brownsville Ship Channel and the construction of State Highway 48 in the 1930s. Cutting off tidal flow changed this highly productive shallow water system — which once boasted a shrimp fishery — into a massive salty sand flat (facing page). With the Bahia Grande dried up, the area provided few ecological benefits, and its wind-blown sands caused numerous health problems in the Brownsville area.

In 2005, local authorities opened a pilot channel (above) between the Brownsville Ship Channel and the Bahia Grande, reconnecting permanent tidal flow to the area for the first time in 70 years (right). The pilot channel was only an initial step in restoring the degraded wetlands of the Bahia Grande. Additional channels, funded by NOAA, will be constructed between the Bahia Grande and adjacent basins — Little Laguna Madre and Laguna Larga — to enhance water circulation throughout the area and to reestablish native mangrove stands and seagrass beds.





*Monitor*

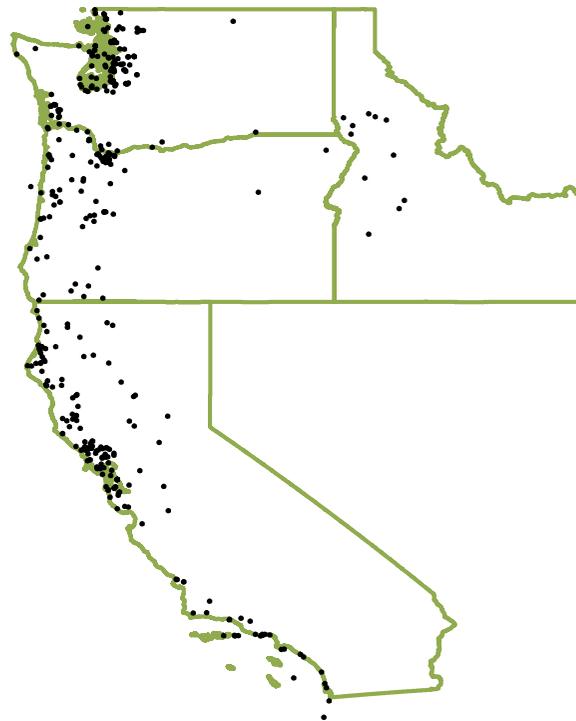
restoration project success

# West Coast Projects

The western coastal states abound in a remarkable array of habitats and coastal species. Nearly 10,000 miles of shoreline encompass diverse and productive habitats that support finfish, shellfish, and other wildlife. The region's picturesque rivers and streams provide rearing and spawning habitat for anadromous fish — species that spend part of their lives in freshwater and part of their lives in saltwater. Salmon, an important recreational fishery and cultural icon, rely on these networks of estuaries and streams to complete their life cycles. Olympia oysters, once an important food source for Native Americans, can provide habitat for many marine species. Kelp beds, sea grasses, salt marshes, and other wetlands also serve as important shelter, food sources, and spawning habitats.

Unfortunately, many of these habitats have diminished greatly in recent years. Bulkheads and armoring modify 33 percent of Washington's shoreline. Dams, irrigation diversions, and road crossings in Idaho limit fish access to thousands of miles of upstream salmon habitat. In Oregon, approximately 50 percent of historic tidal wetlands have been lost, and in parts of California nearly 80 percent of tidal wetlands have been damaged or destroyed.

The loss and degradation of these habitats has resulted in greatly reduced fisheries populations. Chinook, coho, pink, and chum salmon, as well as steelhead trout are now listed under the Endangered Species Act, and the native Olympia oyster no longer supports a large commercial harvest. NOAA's Community-based Restoration Program has been active throughout the West Coast region since 1996, funding hundreds of projects to help reverse habitat decline.



On the West Coast, NOAA's Community-based Restoration Program works in a variety of habitats from marine kelp forests (above) to coastal oyster beds (facing page) and inland riparian streams (below). Habitat restoration projects throughout Washington, Oregon, California, and Idaho (see map) provide important benefits for the region's fish and wildlife.



## WASHINGTON



### PUGET SOUND, WA

Derelict gear includes equipment such as nets, lines, and crab and shrimp pots abandoned or lost during commercial or sport fishing operations. The abandoned gear is typically composed of synthetic materials, which can remain in the marine environment for years or even decades, trapping and killing marine species. Recently recovered derelict nets on the Pacific Coast of Washington that had been “ghost fishing” for over 15 years contained carcasses of sea birds, marine mammals, and mature salmon returning to spawn.

Through grants provided by NOAA, the Northwest Straits Commission developed derelict gear removal protocols focusing on safe and environmentally friendly removal and disposal of the derelict fishing gear. Since 2001, gear removal efforts have recovered 686 shrimp and crab pots and 3.15 million square feet of nets. Fishing gear is brought to the surface by floats or reels (above, left), pulled out of the water, and placed onto the recovery vessel for disposal (above, center). To date, 498 entangled salmon and rockfish, 1,100 live and dead crabs, and four dead marine mammals have been removed from the retrieved gear (left and above, right). The protocol, adopted by the Washington State Department of Fish and Wildlife, has encouraged further gear removal projects in Puget Sound and King County.

## WASHINGTON



### TARBOO CREEK, WA

From the forested headwaters, to the farmed floodplain, to the estuarine Dabob Bay (above, left), Tarboo Creek has all the ingredients necessary for watershed-wide protection and restoration despite its degraded floodplains, blocked streams, and imperfect forestry practices.

NOAA's Community-based Restoration Program has played a substantial role in several restoration projects in this watershed and has worked with many local partners, including the Northwest Watershed Institute, Hood Canal Salmon Enhancement Group, and National Fish and Wildlife Foundation. Through several NOAA-funded restoration efforts, local partners removed a series of fish passage barriers (above, center), opening over 17 miles of spawning and rearing habitat in the Tarboo watershed to salmon (above, right). NOAA helped return over 1,500 feet of Tarboo Creek from a ditch to its natural meandering course on the Old Freeman Farm, and NOAA partners and volunteers also planted the floodplain with native shrubs and trees, and placed large logs in the stream to recreate the aquatic refuges found in healthier creeks.

Tarboo Creek will develop, change, and grow, but the foundation for a healthy watershed has been established. Today, local school children come to the creek, watch the coho push upstream, and become involved in watershed restoration. Equipped with these experiences, these children can become tomorrow's river stewards, acting to protect this rich natural resource for future generations.

*“Habitat is the key to the survival of wild salmon. When we, as a community, take care of the salmon's home, we are taking care of our home, too. We must work together – all of us – to protect and restore the salmon for our children, and for generations to come.”*

**Billy Frank, Jr.**

*Chairman,  
Northwest Indian Fisheries Commission*

IDAHO



## IDAHO



### ROUND VALLEY CREEK, ID

The NOAA-supported Idaho Department of Fish and Game's Volunteer Program provides a link between conservation-minded citizens and ecologically meaningful habitat restoration. In the program's southwest region, 2,100 volunteers have committed over 20,500 hours of service (above and right) to restore wetland and riparian areas essential to Idaho's migrating salmon. The volunteer program stretches limited resources to implement high-priority projects that would not be possible otherwise.

The program relies on members of the local communities to facilitate restoration on private lands that were previously inaccessible to government personnel. Through volunteer efforts, local landowners have begun opening their gates to become partners in habitat restoration efforts (facing page). As other landowners witness successful projects on their neighbors' properties, they come to recognize the benefits of healing the rivers and creeks. Each year, a growing number of Little Salmon River Valley landowners partner with the volunteer program and other natural resources agencies to work cooperatively toward habitat restoration.



## OREGON



### LOWER DRIFT CREEK, OR

Alsea Bay on the Oregon Coast provides important habitat for many marine species, including Pacific herring, English sole, dungeness crab, and harbor seals (above). The Bay also hosts Chinook, coho, and chum salmon, as well as steelhead and sea-run cutthroat trout.

When the Drift Creek valley near Alsea Bay was originally colonized, some of the associated salt and freshwater marshes were diked, drained, and converted to pasture. To restore the area, the MidCoast Watershed Council and the Siuslaw National Forest, with NOAA support, removed a man-made levee (above, left), which restored the tidal connection between Lower Drift Creek and approximately 82 acres of wetland habitat (left). On the first high tide following the levee removal, thousands of juvenile fish were observed in the newly available shallow marsh habitat. Other restoration activities included controlling invasive plants, revegetating the area with native plants, removing culverts that blocked fish passage, and installing fencing and guards to prevent cattle from grazing upstream and impacting the newly restored area.

## OREGON



“Native oysters have been a major food source for Native Americans in the Yaquina Bay area for thousands of years. Commercial harvests from San Francisco in the 1800s took nearly everything. How do I feel about this first step to put oysters back? It’s the beginning of a new life. We want oysters here, not just for Native Americans, but for all.”

Frank Simmons

Siletz Tribal Elder and Natural Resources Technician

### YAQUINA BAY, OR

The native Olympia oyster (above) was historically found in bays and estuaries along the West Coast, from Mexico to southeastern Alaska. Intense harvest during the 19th century, as well as later development and pollution, exhausted oyster populations along the coast, and only small remnant populations remain today. With support from NOAA and student volunteers, the Confederated Tribes of Siletz Indians began restoring native Yaquina Bay oysters in 2004.

The Siletz Indians collect native oyster broodstock from Netarts Bay, and spawn and grow the oysters at the Whiskey Creek Shellfish Hatchery. When the oysters reach an appropriate age, the tribe then transplants them to state-owned sites within Yaquina Bay (right).

With recreational harvest of Olympia oysters currently prohibited in Oregon, increased harvest is not the primary goal of this project; rather, the goal is to rebuild the foundation of a healthy estuarine ecosystem, enhancing habitat and water quality to benefit many other species.



## CALIFORNIA



### SOUTHERN CALIFORNIA BIGHT, CA

Giant kelp was once abundant along the southern California coast from north of Monterey to San Diego. Giant kelp (above) can grow up to 2 feet per day, and kelp forests support a diversity of marine species, including rubberlip surfperch (left, top), anchovy (left, bottom), lingcod, and sea otters. However, these marine forests have decreased by 80 percent in southern California, and some areas are now almost completely destroyed. Under normal conditions, giant kelp will recolonize an area following destructive storms or periods of increased water temperatures, but pollution and disease still challenge natural kelp regeneration.



Healthy, dense giant kelp forests can be reestablished using techniques that have been successfully tested and refined since the 1970s. The California Coastkeeper Alliance, in partnership with NOAA, has launched the Southern California Regional Kelp Restoration Project, a community-based program to restore the kelp forests of southern California from Santa Barbara to San Diego. Since the project's inception in 2001, divers and other volunteers have donated thousands of hours to growing, maintaining, transplanting, and monitoring the kelp, and have restored thousands of square meters of kelp forest.

## CALIFORNIA



### COASTAL STREAMS, CA

California's coastal streams are home to coho and Chinook salmon and steelhead, which have been classified as threatened or endangered throughout much of their ranges. Though well-adapted to withstand high water flows in winter and low flows in summer, these fish require healthy instream and riparian habitat to survive in their highly dynamic environments. Unfortunately, many of California's streams have been heavily damaged by development pressures and past land use practices.

With NOAA funding, the California Conservation Corps (CCC) trains young adults and provides them with a variety of opportunities to conduct hands-on restoration. In northern California, CCC crews installed large woody debris in Austin Creek near the Russian River (above) to provide instream habitat for coho salmon and steelhead. In southern California, CCC crews stabilized a 60-foot section of eroding stream bank and planted native vegetation along Lion Creek, which supports steelhead. Crews also repaired existing riparian fencing (right) to keep livestock out of the creek. These habitat improvements are small steps toward salmon and steelhead recovery along the California coast.

*“Communities and government are working hand in hand in California to restore habitat for our marine resources. The partnership between the California Conservation Corps and NOAA is an excellent example of how these efforts will help sustain our commercial and recreational fisheries, and ensure the health of our environment for the children of tomorrow.”*

Mike Chrisman

Secretary for Resources, State of California



# Alaska and Pacific Island Projects



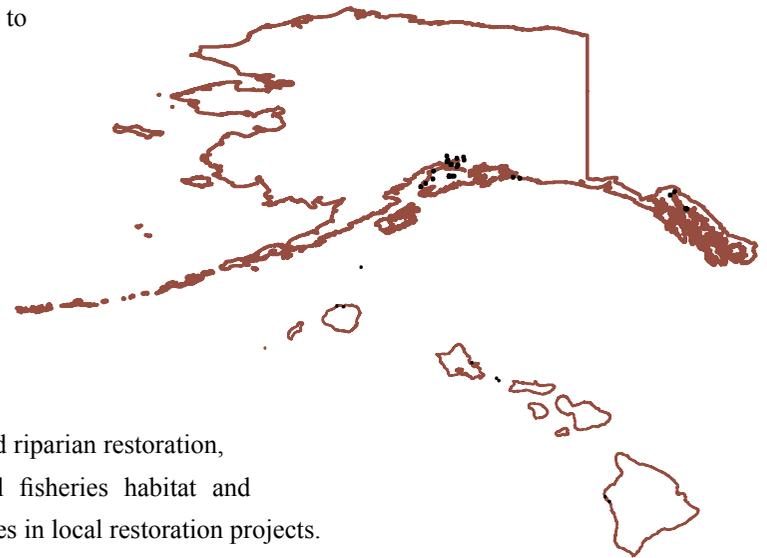
From invasive species removal (facing page) and shellfish restoration to stream enhancements and riparian restoration (above and below), NOAA's Community-based Restoration Program supports vital fisheries habitat restoration projects throughout the vast regions of Alaska and the Pacific Islands (see map).



Alaska and the Pacific Islands span the North and West Pacific Ocean, as far north as the Arctic Circle and as far south as the equator. Alaska has more than 33,000 miles of tidal coastline, and the exclusive economic zones of the Pacific Islands cover more than 1.5 million square miles of ocean. Alaska, Hawaii, and the island territories share many similarities — close ties with native communities and cultural resources, a large commercial fishing industry, remote and unique natural beauty, and rapid coastal development. Yet the North and West Pacific are worlds apart in terms of habitat types, climates, and geography.

Although Alaska's environment ranks among the most pristine in the world, coastal development, resource extraction, pollution, and marine traffic have all contributed to localized habitat degradation. Alaska provides close to 40 percent of the nation's wild salmon catch, but more than half of the culverts in salmon streams obstruct fish passage to native spawning grounds. In the Pacific Islands, marine debris, invasive species, and urbanization have contributed to coastal and marine habitat degradation. Coral reefs, which contribute more than \$360 million to the Hawaiian economy each year, suffer from derelict fishing net abrasion, highly invasive marine algae, and sedimentation due to channelized urban streams.

In Alaska and the Pacific Islands, NOAA partners with grassroots organizations and state and federal agencies to address local habitat restoration needs. From invasive species removal and shellfish restoration to marine debris removal and riparian restoration, the Community-based Restoration Program repairs crucial fisheries habitat and establishes a conservation ethic by involving local communities in local restoration projects.





Promote environmental  
*stewardship*

## ALASKA



### EYAK LAKE, AK

Over the years, sockeye salmon production from Eyak Lake has sustained Native Alaskan populations and today it supports a modern-day fishing fleet. Eyak Lake, which flows via the Eyak River into the Copper River Delta, is noted for the length of its sockeye salmon run and receives some of the earliest and the latest ocean returns. The early return of sockeye to the Copper River Delta historically provided welcome bounty after long winters. Today, the high oil quantity and deep red flesh of this area's sockeye salmon make it a specialty on the international fish market.

Unfortunately, urban growth in nearby Cordova has diminished the functioning habitat available for salmon populations. Problems include polluted storm water outflow, eroded banks from shoreside construction, and disrupted spawning grounds from in-water structures such as docks.

With local partners, NOAA's Community-based Restoration Program has dedicated funding to restore functioning habitat on Eyak Lake. This streambank restoration project brought together volunteers and professional contractors to secure the bank using bioengineering techniques such as soil and willow wraps, root wad structures, and revegetation (above and left).

## ALASKA



### QUARTZ CREEK, AK

Although large river systems like the Yukon, Kenai, Copper, and Russian rivers are famous for producing salmon, it is the tributaries of these great rivers that actually provide much of the spawning and rearing habitat for Alaska's juvenile salmon. Many of these tributaries have been degraded by human activities. Abandoned gravel mines, for example, can alter stream courses and increase turbidity levels — both of which can be detrimental to salmon.

Quartz Creek, a tributary of the Kenai River, has been the focus of NOAA efforts to improve rearing habitat for juvenile salmon. In the Quartz Creek project, an abandoned gravel pit mine was transformed into a wetland pond and connected to the creek channel. To restore the creek's stream banks, volunteers anchored a fallen tree along the shore and bank (above, left). The tree will slow water velocity and create shelter for juvenile fish. Additional stream bank protection was added using other bioengineering techniques (above, center and right).

*“Working as part of an Alaska Youth Restoration Corps team, young adults will move more than just mountains of soil, sod, root wads and trees. They will become the stewards of our environment, and they will move their generation to respect and protect the natural resources around them.”*

**Elvira Wolfe**

*Director, Alaska Youth Restoration Corps*

## HAWAII



## O'AHU, HI

The spread of invasive marine algae is one of the greatest threats to Hawaii's coral reef ecosystems. In the absence of natural control mechanisms, such as fish grazing, disease, and competition, these alien algae species can quickly overgrow and smother native reef communities. With NOAA funding, The Nature Conservancy of Hawaii cultivated one of the largest grassroots partnerships in Hawaii to combat the spread of alien algae and restore native reef habitat in Waikiki and Kane'ohe Bay.

Community volunteers devote Saturday mornings to manually removing the alien algae from reefs in Waikiki. Trained divers retrieve the algae from the sea bottom using burlap bags and pass the bags to volunteers on surfboards who paddle them to shore (above, left). Shore-based volunteers sort out and return any native species that were inadvertently collected (above right and facing page), and the collected algae is then used as fertilizer by local taro farmers. To date, thousands of volunteers have helped remove over 100 tons of alien algae.

By fostering community stewardship through education and volunteerism, this project is making significant strides toward restoring and protecting Hawaii's coral reef ecosystems and maintaining an abundance of marine life, such as endangered green sea turtles (left) that forage on native algae.

## HAWAII





# Credits

## Photography

*Introduction (river herring): Tim Watts; ME (river herring): Tim Watts; NH (all): New Hampshire Department of Environmental Services - Dams Bureau; VT (community restoration): FishAmerica Foundation; VT (Atlantic salmon): Gilbert van Ryckevorsel; MA (train): Andrew Eldridge; RI (volunteers hand transplanting, woman in water monitoring): Thomas Freeman; CT (river herring): Tim Watts; NJ (all): NY/NJ Baykeeper; PA (dam before): Reading Public Museum; DE (elvers): Tim Watts; DC (boy with trash, smiling girl): Anacostia Watershed Society; South Atlantic Overview (brittle star): Andy Bruckner; NC (aerial shots, North River planting): North Carolina Coastal Federation; GA (all): Alan Power; FL (volunteers) Wildlife Research Team; FL (manatee, roseate spoonbill): istockphoto.com; Caribbean (moray eel, anemone, reef fish): Andy Bruckner; Gulf of Mexico Overview (crab trap removal): Gulf States Marine Fisheries Commission; Gulf of Mexico Overview (shrimp trawlers): istockphoto.com; MS (all): Gulf States Marine Fisheries Commission; West Coast Overview (Idaho stream): Mountain Visions; West Coast Overview (kelp): California Coastkeeper Alliance; WA (crane lifting net): U.S. Army Corps of Engineers; WA (Pacific salmon): istockphoto.com; ID (all): Mountain Visions; OR (harbor seal): istockphoto.com; CA (rubberlip surfperch): Dave Witting; CA (kelp blades, anchovies): California Coastkeeper Alliance; Alaska and Pacific Islands Overview (volunteers): Hawaii Marine Algae Group; Alaska and Pacific Islands Overview (bear with salmon): istockphoto.com; AK (Eyak Lake): Copper River Watershed Project; AK (Quartz Creek): Youth Restoration Corps; HI (volunteers): Hawaii Marine Algae Group; HI (sea turtle): John Naughton.*

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## Special Thanks

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*“By educating the public about these environmental issues, and with the hands-on approach to activate that knowledge, an individual becomes better equipped and informed to make decisions as he/she develops a personal stake in affecting the environment.”*

Andi Olsen,

*Idaho landowner and partner in NOAA community-based restoration efforts*

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